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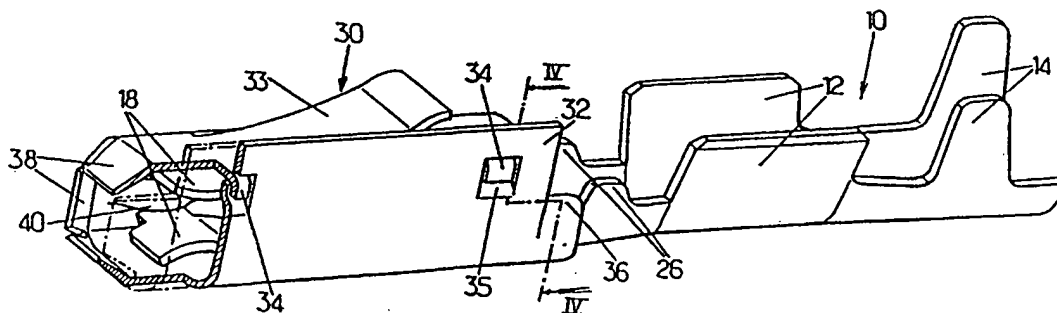


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(54) Title: ELECTRICAL CONNECTION TERMINAL WITH A CAGE



(57) Abstract

The present invention relates to a femal electrical connection terminal consisting of a one-piece contact (10), made of cut and bent sheet, comprising a rear shank for permanent connection to a conductor and a front body having a base of rectangular cross section, the two opposed faces of which are extended forwards by contact blades (18) which converge, and of a protective cage of rectangular cross section which surrounds the body. The cage (30) has inwardly projecting means (40) which limit the extent to which the contact blades (18) come together and which keep them prestressed.

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ELECTRICAL CONNECTION TERMINAL WITH A CAGE

The present invention relates to female electrical connection terminals consisting of a one-piece contact, made of cut and bent sheet, these terminals being intended to receive a pin, and especially a pin of square cross section, and of a protective cage.

It relates more particularly to an electrical connection terminal whose contact comprises a rear shank for permanent connection to a conductor and a front body having a tubular base of rectangular cross section, the two opposed faces of which are extended forwards by respective opposed contact blades which converge and the protective cage of which, of rectangular cross section, surrounds the body. Many contact terminals of this type already exist, such as that described in German Utility Model G 86 08 199.

The purpose of the present invention is especially to provide an electrical connection terminal of the type defined above, which is capable of being miniaturized and ensures good electrical contact, even on a pin of very small cross section.

For this purpose, the invention proposes a terminal characterized in that the cage has inwardly projecting means which limit the extent to which the contact blades come together and which keep them prestressed.

For this purpose, the invention also proposes a terminal characterized in that the cage has inwardly projecting means which limit the extent to which the contact blades come together and keep them prestressed, these means consisting of a cut and bent tab attached to the rest of the cage only at the rear.

Advantageously, the contact blades each have, at the point where they bear on the tab, a lateral projection which engages in a window made on each side of the blade; this window limits the movement of the projections; it allows them to move apart.

- 2 -

The cage must be fixed to the contact. In particular, it may be crimped to it. For example, the base of the contact may be joined to the shank by a region whose edges have projecting tabs which, together
5 with the rear edge of the base, define a region in which the cage is crimped by bending over the tongues located at the rear of the cage.

The faces of the cage are advantageously extended forwards by converging noses which are
10 intended to keep a pin centred while it is being inserted into the terminal and thus to protect the contact blades.

For this purpose, the contact blades extend two of the faces of the tubular base forwards and each has
15 a longitudinal protuberance for reinforcement.

This protuberance increases the stiffness of the blades, thereby increasing the contact force that they are capable of applying to the pin and making them less fragile.

20 In general, the end of the blades will be shaped so that the regions coming into contact with the pin have an outwardly flaring convex shape in order to make it easy for the pin to enter.

Advantageously, the tubular base consists of a
25 portion of cut sheet having four 90° bends, one of the lateral edges of the portion having a central notch into which a projection of corresponding shape on the other lateral edge fits, in a face other than those extended by the blades.

30 Such a contact will generally be made of a material having a high electrical conductivity, especially pure copper or a copper alloy. Since copper has relatively poor mechanical properties, even in the alloy state, the invention also proposes an electrical
35 contact terminal consisting of a contact of the abovementioned kind and a protective cage of rectangular section surrounding the body, which is provided with means for crimping it onto the contact, and protects the contact from being crushed. This cage

- 3 -

may also be provided for keeping the blades under a prestress which makes it possible to achieve a higher bearing force on the pin.

The above characteristics, as well as others, will become clearer on reading the following description of one particular embodiment of the invention, this being given by way of non-limiting example. The description refers to the drawings which accompany it, in which:

10 - Figure 1 is a perspective view of a terminal according to the invention, with a partial cut-away intended to reveal the means for prestressing the blades;

15 - Figure 2 is a perspective view of the terminal, seen from the opposite side to that in the Figure 1;

 - Figure 3 is an exploded perspective view showing the contact and the cage intended to be fitted onto the contact in order to constitute a terminal;

20 - Figure 4 is a perspective view in cross section on the planes indicated by the arrows IV-IV in Figure 1;

 - Figure 5 is a perspective view of a terminal according to the invention;

25 - Figure 6 is a perspective view of the terminal according to a variant of Figure 1, with the cage cut away so as to reveal the prestressing means;

 - Figure 7 shows a flat blank intended to form the contact of a terminal according to Figures 1 and 2;

30 - Figure 8 is a top view showing the terminal formed and still joined to a supply strip;

 - Figure 9 is a perspective view, in partial section, showing the terminal assembled, in partial section on a plane parallel to the mid-plane of the terminal; and

35 - Figure 10 is a plan view of the terminal still attached to a residual strip of the sheet for manufacturing the contact.

- 4 -

The terminal shown in the figures comprises a contact 10, generally made of a copper-based alloy, and a protective cage 30, generally made of steel.

5 The contact 10 may be regarded as having a rear shank for permanent connection to a conductor and a front body intended to receive a male contact pin of square cross section. The shank shown is intended to be crimped onto a conductor and, for this reason, has two sets of tongues 12 and 14 which are respectively
10 intended to be crimped onto the core and onto the sheath of an electrical wire (not shown). It could also be provided with wire insulation-displacement flanks.

The contact body has a tubular base 16 of rectangular cross section, formed by four 90° bends
15 from a cut sheet. Two of the faces of the base 16 are extended forwards by contact blades 18. These blades are bent at their root and are shaped so that they converge forwards and then have a convex region which bears on the pin when the latter has been put into
20 place. The flared end part of the blades makes it easy for the pin to be inserted.

The base, since it is formed by bending, has two edges which must be joined together. This join is made in one of the two faces of the base which are not
25 provided with blades. In order to reinforce the base and also to cause correct alignment of the blades 18, the join may comprise interlocking. In the case illustrated in Figure 3, this is achieved by providing, in one of the edges, a notch 22 into which a projection
30 24 of corresponding shape on the other piece engages.

In the case illustrated in Figures 1 to 3, the shank has the shape of a trough, the tongues 12 and 14 of which project in a direction transverse to the blades 18. The contact could also be formed with
35 tongues approximately parallel to the blades.

The base 16 is joined to the shank by a region which, in the embodiment illustrated, is intended to allow the cage 30 to be fitted by crimping. This intermediate joining region is in the form of a trough

- 5 -

which extends that of the shank, but each of its edges has a projecting tab 26. The region lying between the rear edge of the base and the tabs is used for fitting the cage by crimping, as will be seen later.

5 The contact shown in Figures 2 and 3 also includes an outwardly facing boss 28 in the middle of at least one of the faces extended by a blade 18. This boss may be obtained by press deformation during the manufacture, before bending. It is intended to serve as
10 a bearing surface for a locking finger, provided on the cage and to limit the deformation of this finger.

 The cage fulfils several roles. It protects the contact from being crushed. It protects the blades 18, while guiding the complementary pin as it is being
15 inserted. Together with the contact, it forms a lockable terminal in the insulator of a connector. Combining the contact 10 with the cage allows a composite, robust and reliable terminal to be formed, even if it has very small dimensions.

20 The cage 30 shown has a main part of rectangular cross section formed by a strip having three 90° bends. One of the end faces extends beyond the rectangular section and forms a protective wall 32 for the locking finger 33 which is cut in the adjacent
25 wall and deformed outwards. This springy finger 33 is intended to lock the terminal in an insulator.

 The cage is held closed by crimping means. When one of the faces forms a protective wall extending beyond the rectangular cross section, a convenient
30 solution, illustrated in Figures 1 to 4, consists in making, in the wall 32, slots formed by cutting and sinking of two fingers 35. Two lugs 34 projecting from the other edge penetrate these slots and are bent over onto the fingers. They thus lock the cage without in
35 any way projecting outwards from the cage.

 The cage is extended rearwards by two tongues 36 of width corresponding to the gap between the base 16 and one of the tabs 26. These tongues 36 are intended to be crimped in the gap, by bending them as

- 6 -

indicated in the figures, after the cage has been fitted.

The faces of the cage are extended forwards by converging noses 38 intended to keep a pin centred while it is being inserted into the terminal and thus to protect the contact blades 18.

In general, the contact blades 18 will be prestressed, which tends to bring them into contact with each other. However, once the terminal has been assembled, they are kept apart, by a distance which is less than the thickness of the pin intended to be inserted, by means forming part of the cage. These means consist, in the case illustrated, of a slash 40 directed inwards and made in that side wall of the cage which does not form the protective wall 32. Thus, there is no risk of interference between the slash 40 and the lugs 34. Instead of being placed in that face of the cage which is on the same side as the "stitch" which closes the base of the contact body, the slash could be made on the opposite side.

The role of the locking finger 33 is conventional. In the case of the terminal shown, this finger is protected by the wall 32. Its springiness tends to make it project. To prevent it from being accidentally pressed inwards and deformed to a point such that it could then no longer fulfil its locking function, the deformation is limited by it coming into contact with the boss 28 on the contact.

The terminal shown in the Figures 5 and 6 comprises a contact 10, generally made of a copper-based alloy, and a protective cage 30, generally made of steel.

The contact 10 may be regarded as having a rear shank for permanent connection to a conductor and a front body intended to receive a male contact pin of square cross section. The shank shown is intended to be crimped onto a conductor and, for this reason, has two sets of tongues 12 and 14 which are respectively intended to be crimped onto the core and onto the

- 7 -

sheath of an electrical wire (not shown). It could also be provided with wire insulation-displacement flanks.

The contact body has a tubular base 16 of rectangular cross section, formed by four 90° bends from a cut sheet. Two of the faces of the base 16 are extended forwards by contact blades 18. These blades are bent at their root and are shaped so that they converge forwards and then have a convex region which bears on the pin when the latter has been put into place. The shaped end part of the blades makes it easy for the pin to be inserted. The blades may be reinforced and stiffened by a longitudinal protuberance 20, formed by deformation in a press. The protuberances, which generally face inwards, mean that there is no additional thickness.

The contact blades 18 each have, in their convex region intended to bear against the pin, a lateral projection 44 whose function will be explained later.

The base, since it is formed by bending, has two edges which must be joined together. This join is made in one of the two faces of the base which are not provided with blades. In order to reinforce the base and also to cause correct alignment of the blades 18, the join may comprise interlocking. In the case illustrated in Figure 7, this is achieved by providing, in one of the edges, a notch 22 into which a projection 24 of corresponding shape on the other piece engages.

This join or "stitch" is located in that face of the base which lies on the opposite side from that of the lateral projections 44.

In the case illustrated in Figures 5 and 6, the shank has the shape of a trough, the tongues 12 and 14 of which project in a direction transverse to the blades 18. The contact could also be formed with tongues approximately parallel to the blades.

The base 16 is joined to the shank by a region which, in the embodiment illustrated, is intended to allow the cage 30 to be fitted by crimping. This

- 8 -

intermediate joining region is in the form of a trough which extends that of the shank, but each of its edges has a projecting tab 26. The region lying between the rear edge of the base and the tabs is used for fitting the cage by crimping, as will be seen later.

The contact shown in Figures 5 and 6 also includes an outwardly facing boss 28 in the middle of at least one of the faces extended by a blade 18. This boss may be obtained by press deformation during the manufacture, before bending. It is intended to serve as a bearing surface for a locking finger 33 provided on the cage and to limit the deformation of this finger.

The cage fulfils several roles. It protects the contact from being crushed. It protects the blades 18, while guiding the complementary pin as it is being inserted. Together with the contact, it forms a lockable terminal in the insulator of a connector. Combining the contact 10 with the cage 30 allows a composite, robust and reliable terminal to be formed, even if it has very small dimensions.

The cage 30 shown has a main part of rectangular cross section formed by a strip having three 90° bends. One of the end faces extends beyond the rectangular section and forms a protective wall 32 for the locking finger 33 which is cut in the adjacent wall and deformed outwards. This springy finger 33 is intended to lock the terminal in an insulator.

The cage is held closed by crimping means. When one of the faces forms a protective wall extending beyond the rectangular cross section, a convenient solution consists in making, in the wall 32, two slots formed by cutting and sinking of two fingers. Two lugs projecting from the other edge penetrate these slots and are bent over onto the fingers. They thus lock the cage without in any way projecting from the cage towards the outside.

The cage is extended rearwards by two tongues 36 of width corresponding to the gap between the base 16 and one of the tabs 26. These tongues 36 are

- 9 -

intended to be crimped in the gaps, by bending them as indicated in figures 5 and 6, after the cage has been fitted.

5 The faces of the cage are extended forwards by converging noses 38 intended to keep a pin centred while it is being inserted into the terminal and thus to protect the contact blades 18.

10 Means are provided on the cage for keeping, when not in use, the blades 18 apart by a distance which is less than the thickness of a pin but where they have a prestress which tends to move them closer together. In the case illustrated, these means consist of a tab 40 cut and centred inwards, attached only to the rear of the cage. Its inwardly convex portion takes
15 the bearing of the lateral projections 44. In order to allow the blades 18 to move, a window 46 is made in the cut wall. Its width may be just greater than that of the projections in order to guide them. It is preferable to make the tab 40 in the opposite face to
20 that which closes the cage.

The role of the locking finger 33 is conventional. In the case of the terminal shown, this finger is protected by the wall 32. Its springiness tends to make it project. To prevent it from being
25 accidentally pressed inwards and deformed to a point such that it could then no longer fulfil its locking function, the deformation is limited by it coming into contact with the boss 28 on the contact.

In order to allow them to be used on an
30 automatic placing machine, the terminals are advantageously delivered in the form of a tape, all the shanks still being joined to a residual strip 52 (Figure 8).

The contacts are manufactured by cutting them
35 from a reel of sheet, generally copper sheet, in order to form blanks, and then by bending in order to end up with the shape shown in Figure 4. An L-shaped joining foot 48 is formed by cutting a slot 50 so as to allow the blank to be rotated through one quarter of a turn

- 10 -

during manufacture. This simplifies the construction of the tools. By having the slot 50 face the rear with respect to the direction of advance f of the strip during manufacture, it is easier to cut and bend the blanks and there is a reduced risk of buckling. By making that part of the blank which is intended to form the body (Figure 7) face the front, in the direction f, helps to achieve this same result. The cages are manufactured separately, generally made of thin steel sheet, these then being slipped onto the contacts. Once a cage is in place, the tongues 36 are folded down inwards in order to crimp the cage onto the contact.

The contact shown in Figures 3 and 9 consists of a cut and folded sheet. It may be regarded as having a rear shank for permanent connection to a conductor and a front body intended to receive a male contact pin of square cross section. The shank shown is intended to be crimped onto a conductor and, for this reason, has two sets of tongues 12 and 14 which are respectively intended to be crimped onto the core and onto the sheath of an electrical wire (not shown). It could also be provided with wire insulation-displacement flanks.

The contact body has a tubular base 16 of rectangular cross section, formed by four 90° bends from a cut sheet. Two of the faces of the base 16 are extended forwards by contact blades 18. These blades are bent at their root and are shaped so that they converge forwards and then have a convex region which bears on the pin when the latter has been put into place. The flared end part of the blades makes it easy for the pin to be inserted.

In accordance with one aspect of the invention, the blades are reinforced and stiffened by forming a longitudinal protuberance 20, formed by deformation in a press. The protuberances will generally face inwards and do not result in an additional thickness. They start in front of the root of the blades and stop at the convex part. That part of the blades which is

- 11 -

intended to bear on the pin may be wider than the non-bearing part of the blade.

The base, since it is formed by bending, has two edges which must be joined together. This join is made in one of the two faces of the base which is not provided with blades. In order to reinforce the base and also to cause correct alignment of the blades 18, the join may comprise interlocking. In the case illustrated in Figure 3, this is achieved by providing, in one of the edges, a notch 22 into which a projection 24 of corresponding shape on the other piece engages.

In the case illustrated in Figures 3 and 9, the shank has the shape of a trough, the tongues of which project in a direction transverse to the blades 18. The contact could also be formed with tongues approximately parallel to the blades. Wire insulation-displacement flanks could likewise be provided.

The base 16 is joined to the shank by a region which, in the embodiment illustrated, is intended to allow a cage 30 to be fitted by crimping. This intermediate joining region is in the form of a trough which extends that of the shank, but each of its edges has a projecting tab 26. The region lying between the rear edge of the base and the tabs is used for fitting a cage by crimping, as will be seen later.

The contact shown in Figure 3 also includes an outwardly facing boss 28 in the middle of at least one of the faces extended by a blade 18. This boss may be obtained by press deformation during the manufacture, before bending. It is intended to serve as a bearing surface for a locking finger provided on the cage and to limit the deformation of this finger.

The contact 10, generally made of a copper-based alloy, is advantageously combined with a protective cage 30 which, in the case shown, fulfils several roles. It protects the contact from being crushed. It protects the blades 18, while guiding the complementary pin as it is being inserted. Together with the contact, it forms a lockable terminal in the

- 12 -

insulator of a connector. Combining the contact 10 with the cage allows a composite, robust and reliable terminal to be formed, even if it has very small dimensions.

5 The cage 30 shown has a main part of rectangular cross section formed by a strip having three 90° bends. One of the end faces extends beyond the rectangular cross section and forms a protective wall 32 for a locking finger 33 which is cut in the adjacent wall and deformed outwards. This springy
10 finger 33 is intended to lock the terminal in an insulator. The cage is kept closed by two lugs 34 on one of the edges being engaged in slots in the wall 32 and by these lugs being folded down. A window 35 made
15 in the base 16 (Figure 9) allows the rear lug to be folded down.

 The cage is extended rearwards by two tongues 36 of width corresponding to the gap between the base 16 and one of the tabs 26. These tongues 36 are
20 intended to be crimped in the gap, by giving them the shape shown in Figure 3, after the cage has been fitted.

 The faces of the cage are extended forwards by converging noses 38 intended to keep a pin centred while it is being inserted into the terminal and thus
25 to protect the contact blades 18.

 In general, the contact blades 18 will be prestressed, which tends to bring them into contact with each other. However, once the terminal is
30 assembled, they are kept apart by a distance which is less than the thickness of the pin, for example by one or more inwardly facing slashes 40 made in one or both of the lateral faces of the cage (the faces orthogonal to the contact blades).

35 The role of the locking finger 33 is conventional. In the case of the terminal shown, this finger is protected by the wall 32. Its springiness tends to make it project. To prevent it from being accidentally pressed inwards and deformed to a point

- 13 -

such that it could then no longer fulfil its locking function, the deformation is limited by it coming into contact with the boss 28 on the contact.

5 In order to allow the terminals to be used on an automatic placing machine, these terminals are advantageously delivered in the form of a tape, all the shanks still being joined to a residual strip 42.

10 The contacts are manufactured by cutting them from a reel of sheet, generally copper sheet, and then by bending in order to end up with the shape shown in Figure 10. An L-shaped portion 44 is formed so as to allow the contact to be rotated through one quarter of a turn during manufacture. This simplifies the construction of the tools. It may have the orientation
15 shown or the opposite orientation with respect to the direction of advance of the sheet. The cages are manufactured separately, generally made of thin steel sheet, these then being slipped onto the contacts. Once a cage is in place, the tongues 36 are folded down
20 inwards in order to crimp the cage onto the contact.

Many alternative embodiments of the invention are possible. In particular, the contact can be used with a cage of a type different from that described, or even without a cage. In the latter case, a material
25 which is more springy and is mechanically stronger than copper will generally be used to make the contact.

Furthermore, the terminal can be used with a contact of a type other than that which has been described by way of example, and two slashes 40 may be
30 provided.

- 14 -

CLAIMS

1. Female electrical connection terminal consisting of a one-piece contact (10), made of cut and bent sheet, comprising a rear shank for permanent connection to a conductor and a front body having a base of rectangular cross section, the two opposed faces of which are extended forwards by contact blades (18) which converge, and of a protective cage of rectangular cross section which surrounds the body, characterized in that the cage (30) has inwardly projecting means (40) which limit the extent to which the contact blades (18) come together and which keep them prestressed.
2. Electrical connection terminal according to Claim 1, characterized in that the projecting means consist of an inwardly facing slash (40) made in a lateral face of the cage.
3. Electrical connection terminal according to Claim 1, characterized in that the tab (40) is cut and bent and is attached to the rest of the cage only by its rear end.
4. Electrical connection terminal according to one of Claims 1 to 3, characterized in that the contact blades (18) each have, at the point where they bear on the tab, a lateral projection (44) which engages in a window (46) made on each side of the tab.
5. Electrical connection terminal according to one of the preceding claims, characterized in that the base (16) has two edges joined to each other in a face of the base without a blade and opposite the lateral projections.
6. Electrical connection terminal according to one of the preceding claims, characterized in that the cage consists of a strip having three 90° bends and in that one of the end faces extends beyond the rectangular section of the side opposite that comprising the tab (40).

- 15 -

7. Electrical connection terminal according to Claim 6, characterized in that the other end face has two turned-down lugs (34) passing through slots in the projecting end face.

5 8. Terminal according to one of the preceding claims, characterized in that the cage includes a springy finger (33) for locking the terminal, this finger projecting outwards, from the side from which the face of the cage projects.

10 9. Connection terminal according to one of Claims 1 to 4, characterized in that the blades extend two of the faces of the base and each has a longitudinal protuberance (20) for reinforcement.

15 10. Terminal according to Claim 9, characterized in that the end of the blades is shaped so as to have a convex shape in the regions intended to come into contact with a complementary male contact.

20 11. Terminal according to Claim 9 or 10, characterized in that the tubular base (16) consists of a portion having four 90° bends, one edge of which has a central notch (22) into which a projection (24) of corresponding shape on the other edge fits.

FIG.1.

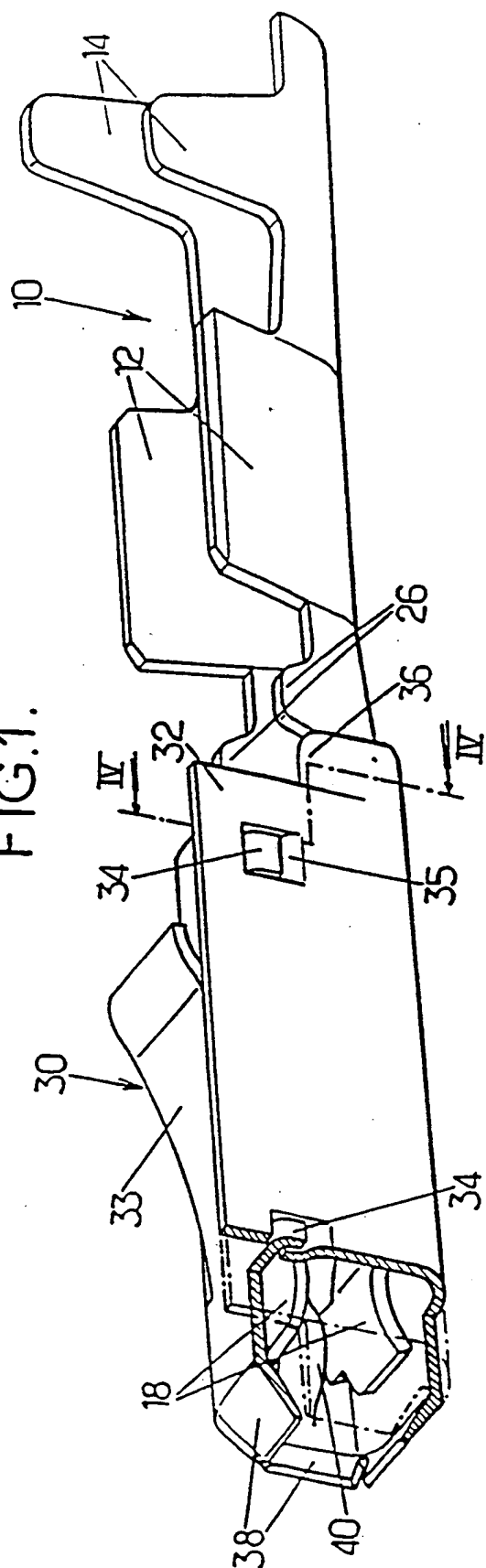
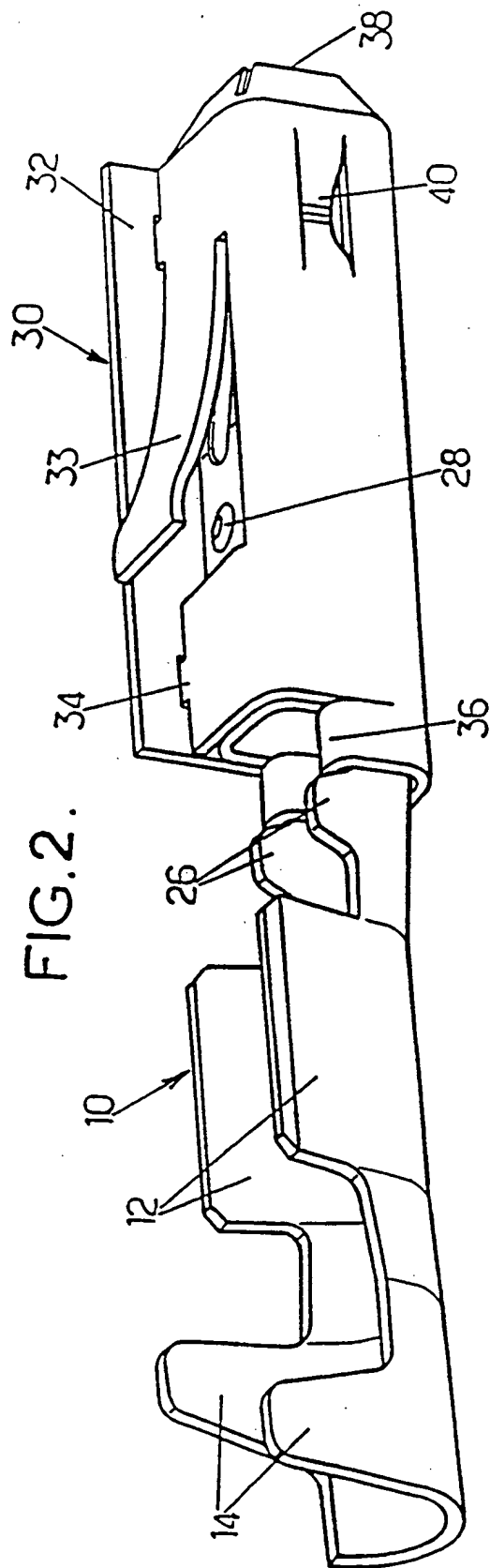


FIG.2.



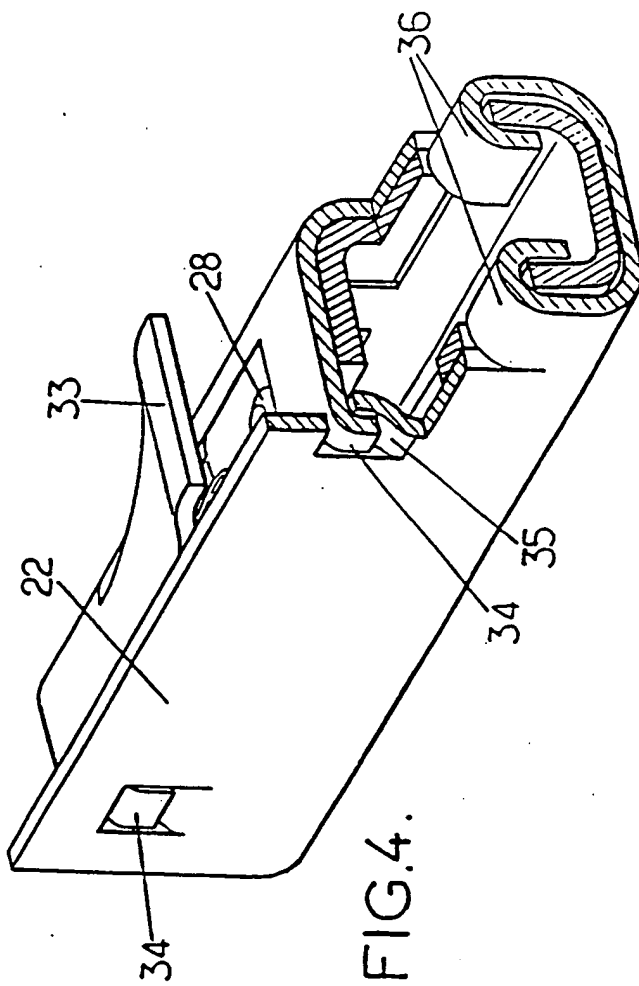
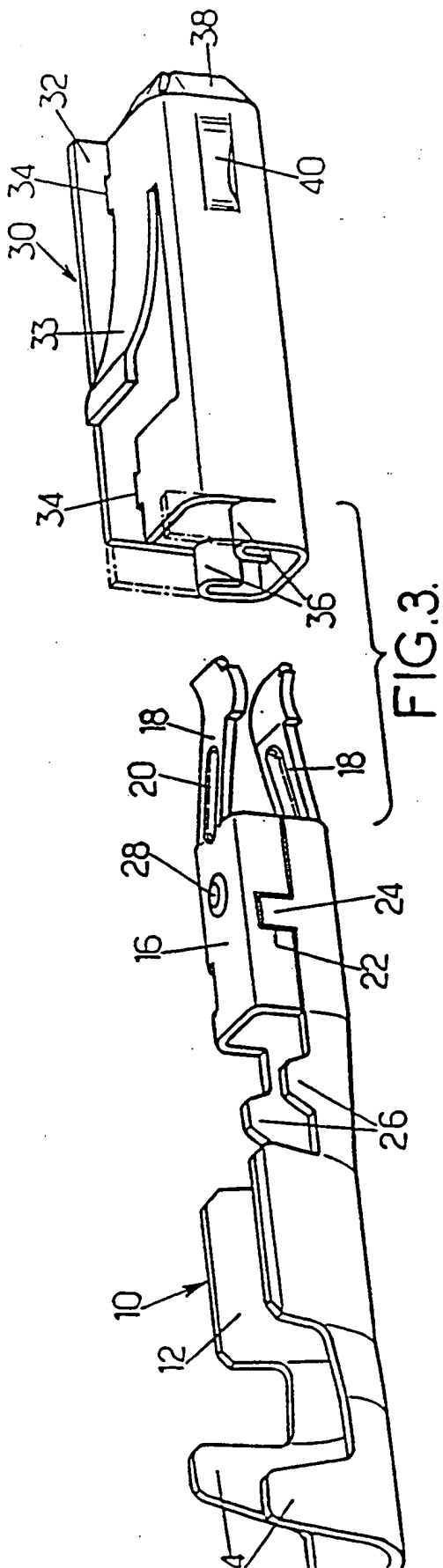


FIG.5.

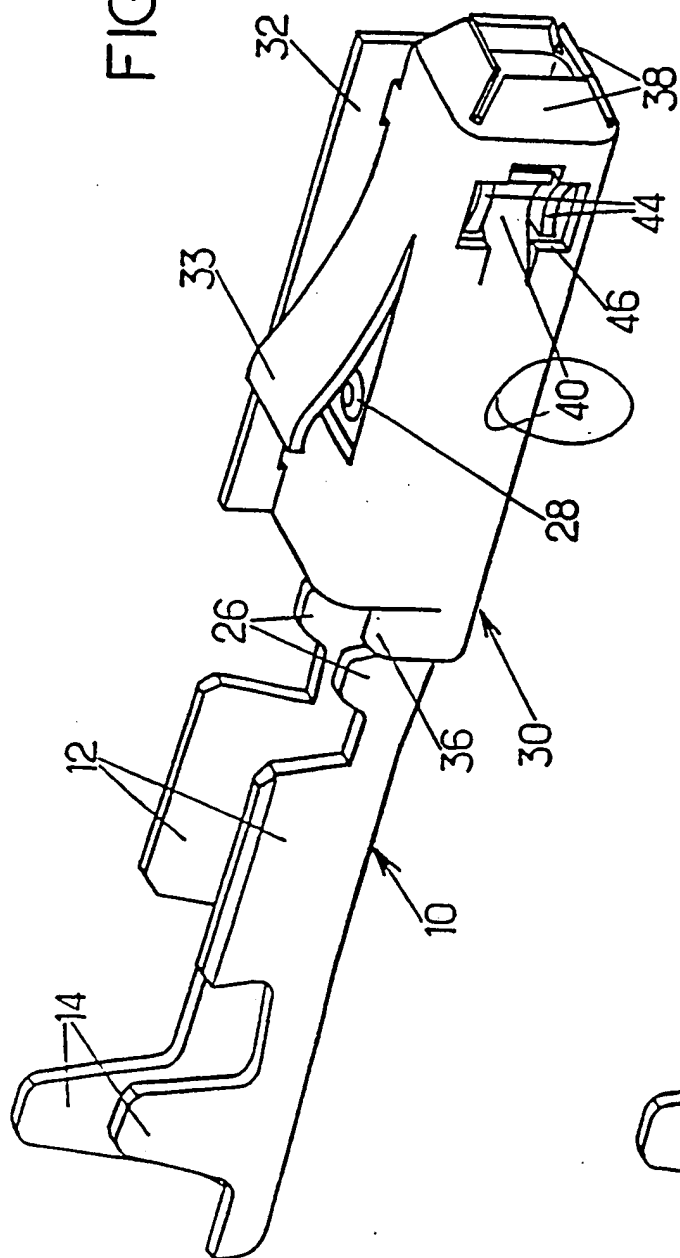


FIG.6.

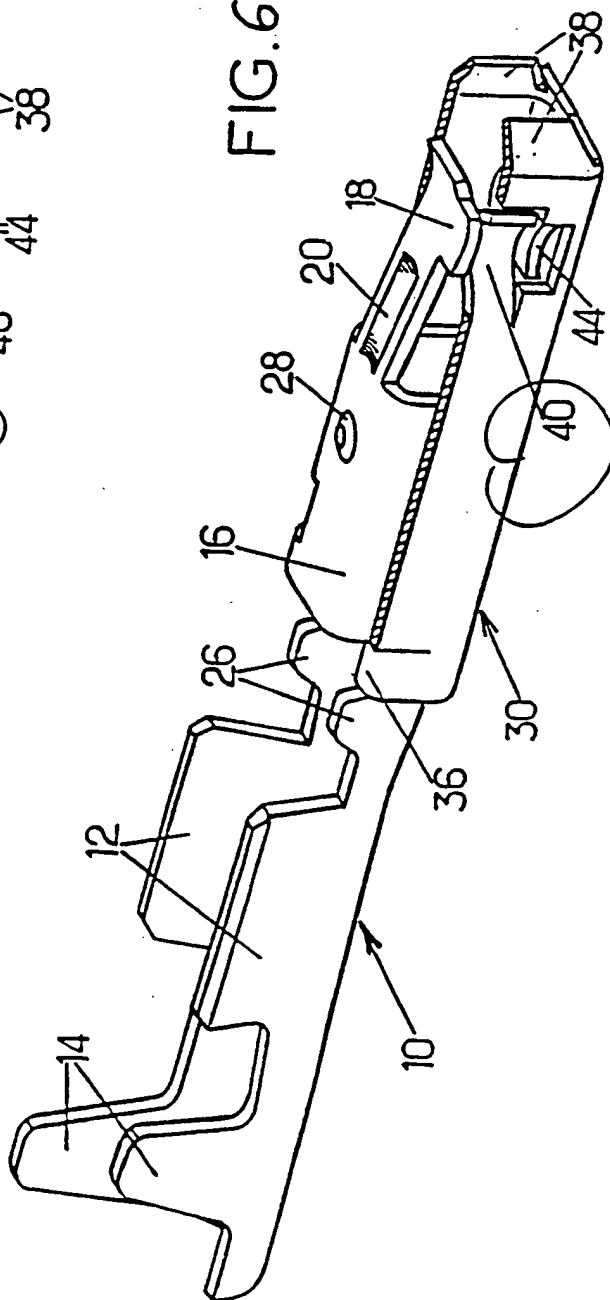


FIG. 7.

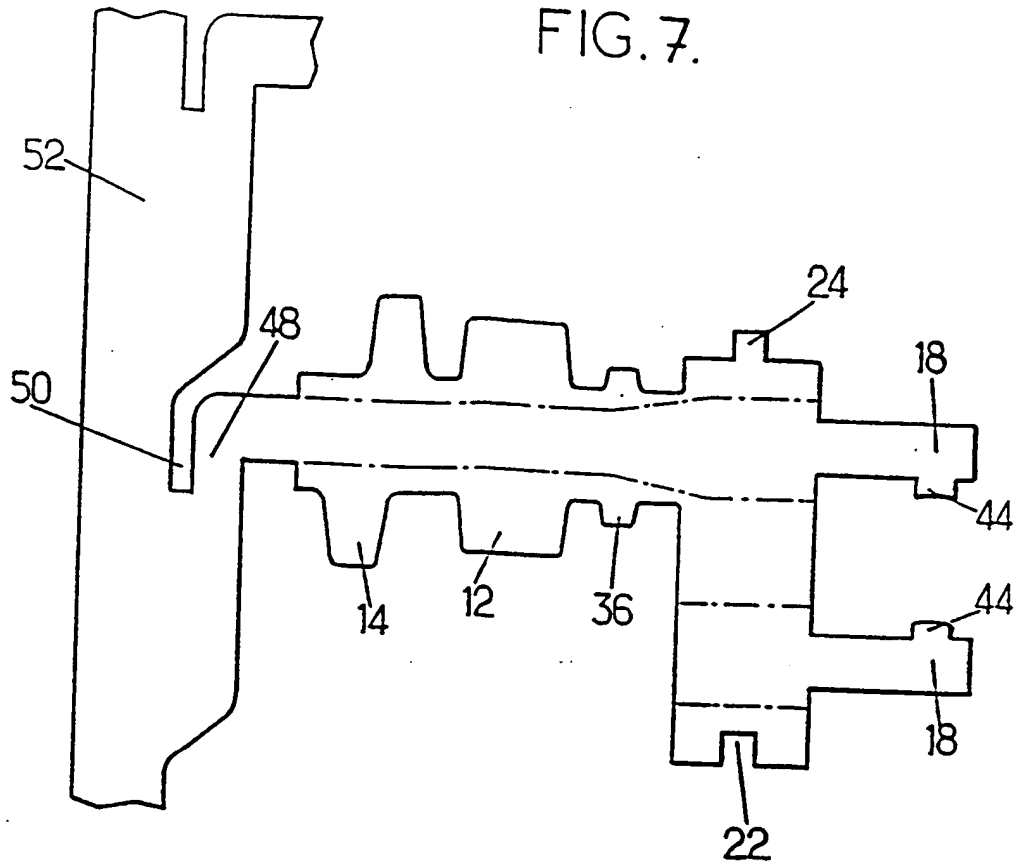
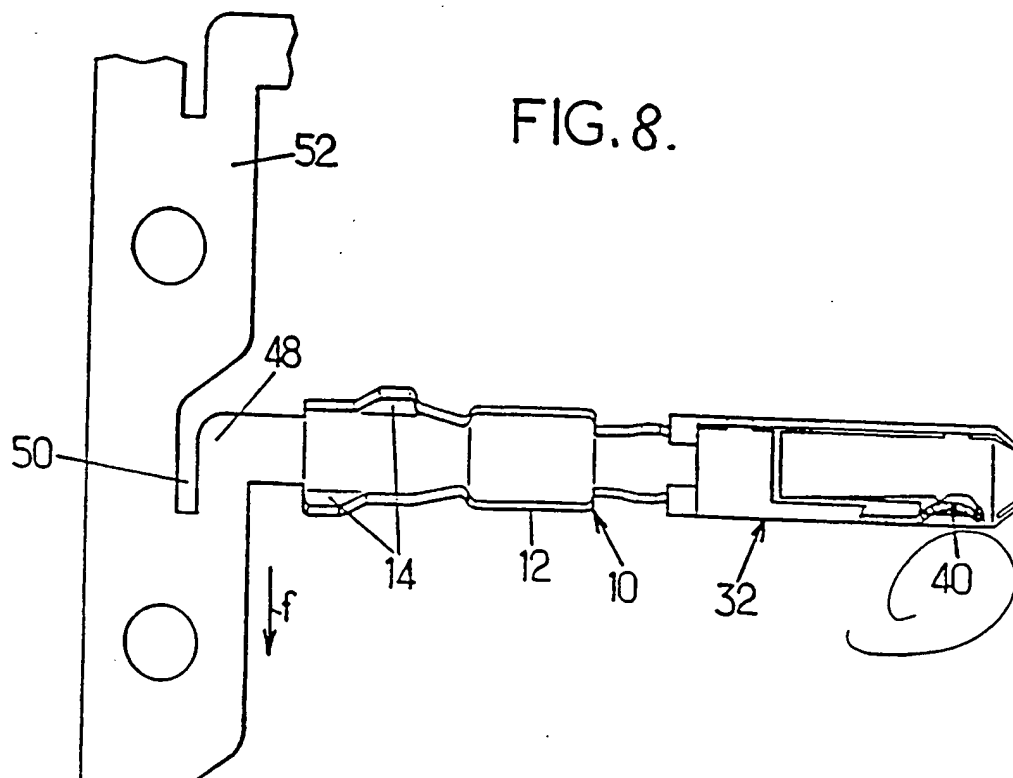


FIG. 8.



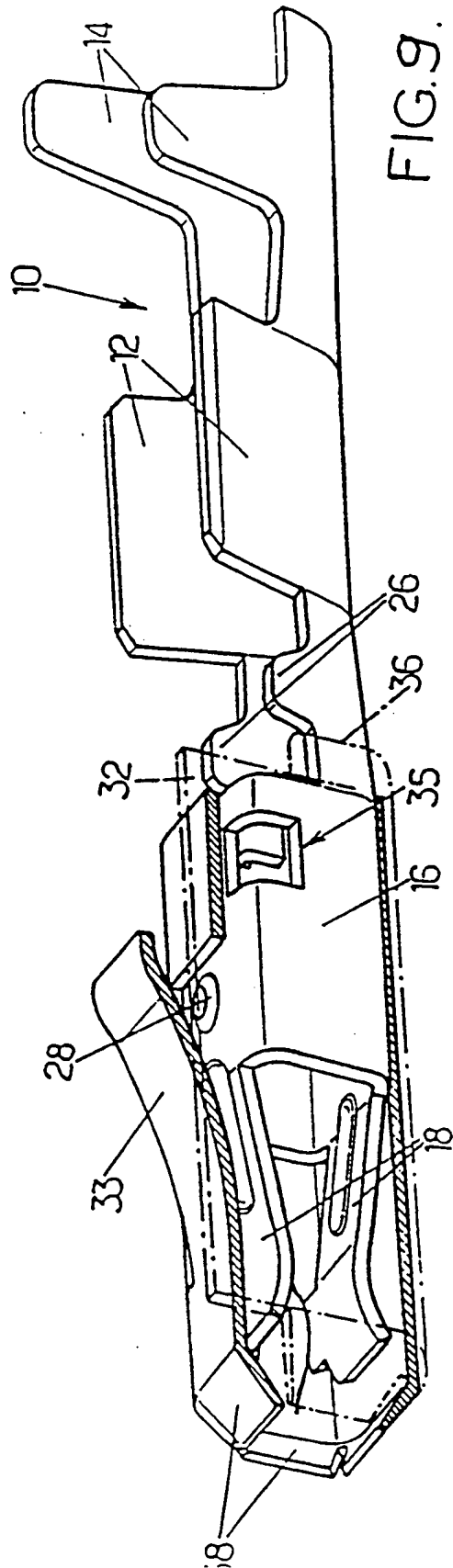
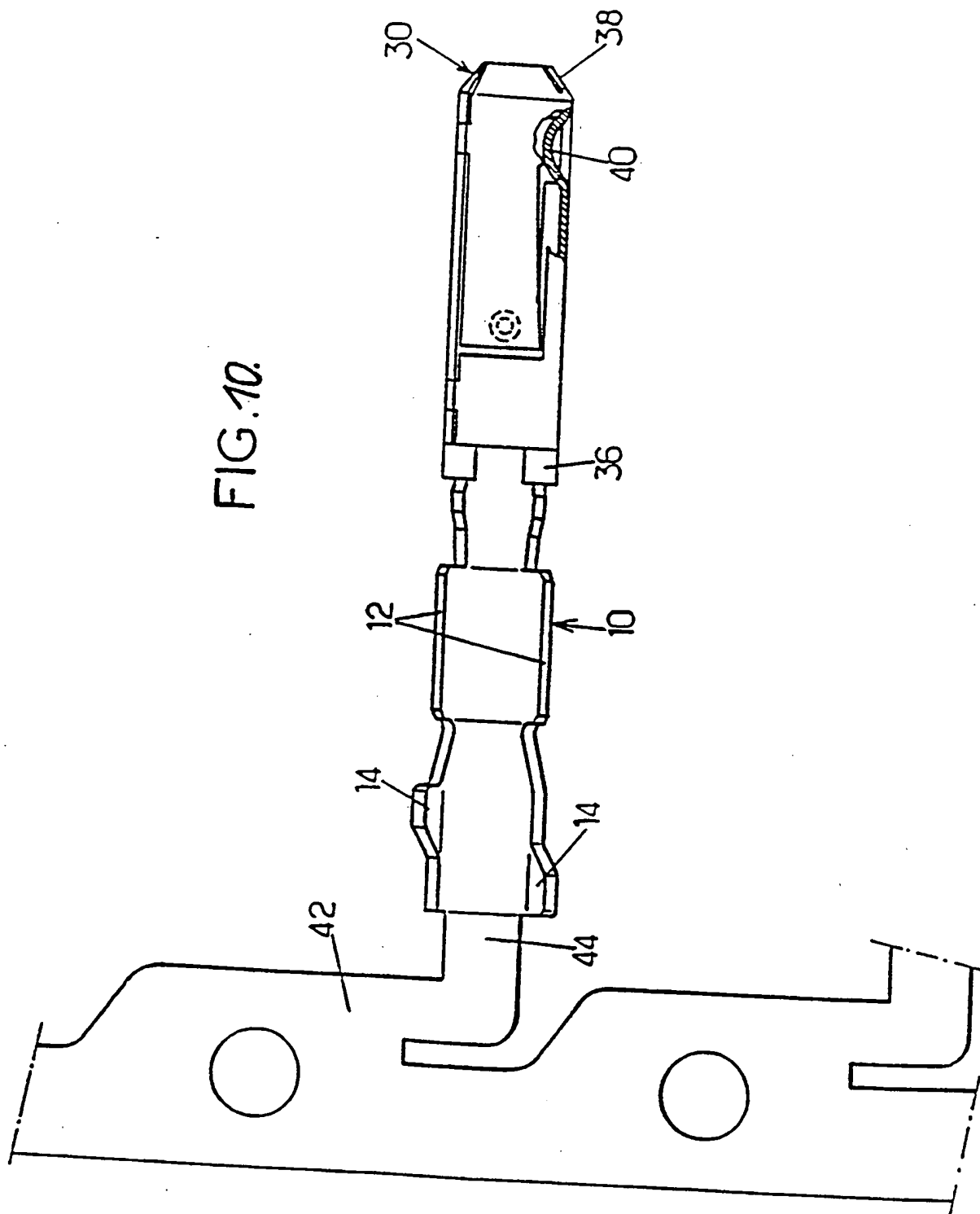


FIG. 10.



INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/00973

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01R13/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	EP 0 658 952 A (CINCH) 21 June 1995 see column 6, line 38 - line 53; claim 6; figures 1,2,7,8,19,20	1,3 2,6-8 4
Y A	EP 0 352 871 A (GROTE & HARTMANN) 31 January 1990 see column 3, line 47 - column 4, line 12; figure 5 see figures 1,5	2 5,10
Y	EP 0 821 436 A (SUMITOMO) 28 January 1998 see column 3, line 41 - line 48 see column 5, line 1 - line 7; figures 1-3	8
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

7 June 1999

Date of mailing of the international search report

16/06/1999

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

Intern: al Application No

PCT/EP 99/00973

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 92 01 047 U (GROTE & HARTMANN) 3 June 1993 see page 9, last paragraph - page 10, paragraph 1; figure 1 ---	3
Y	US 5 281 175 A (J.M.CHUPAC ET AL) 25 January 1994 see column 5, line 66 - column 6, line 14; figures 9,13 -----	6,7

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern 1st Application No

PCT/EP 99/00973

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FIG.1.

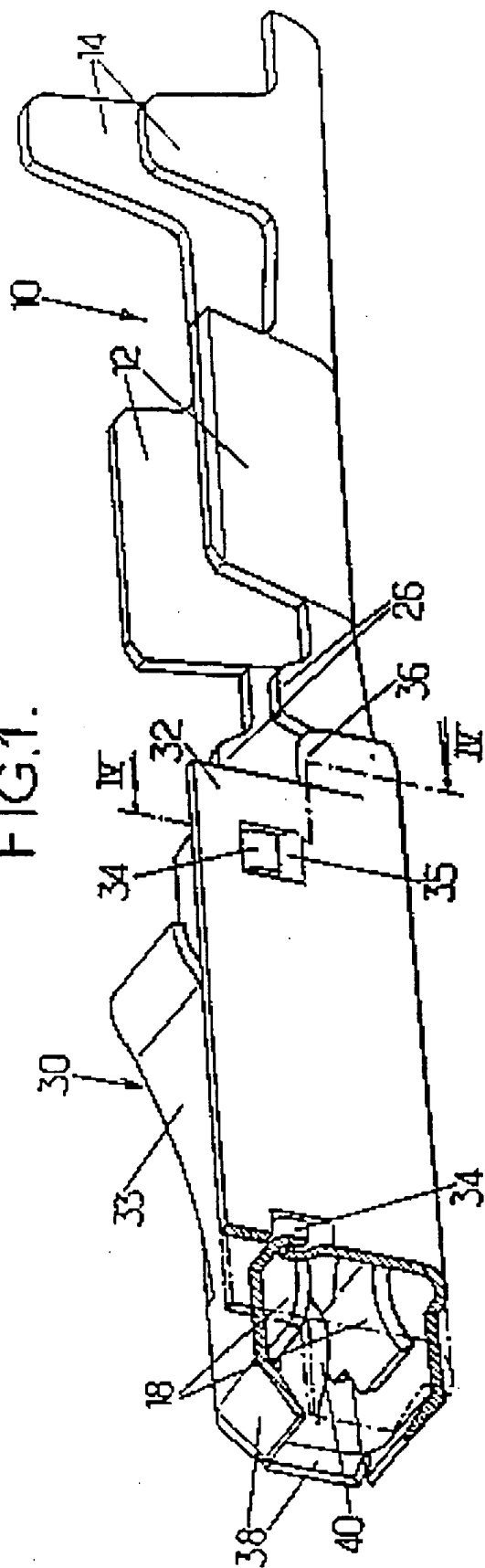
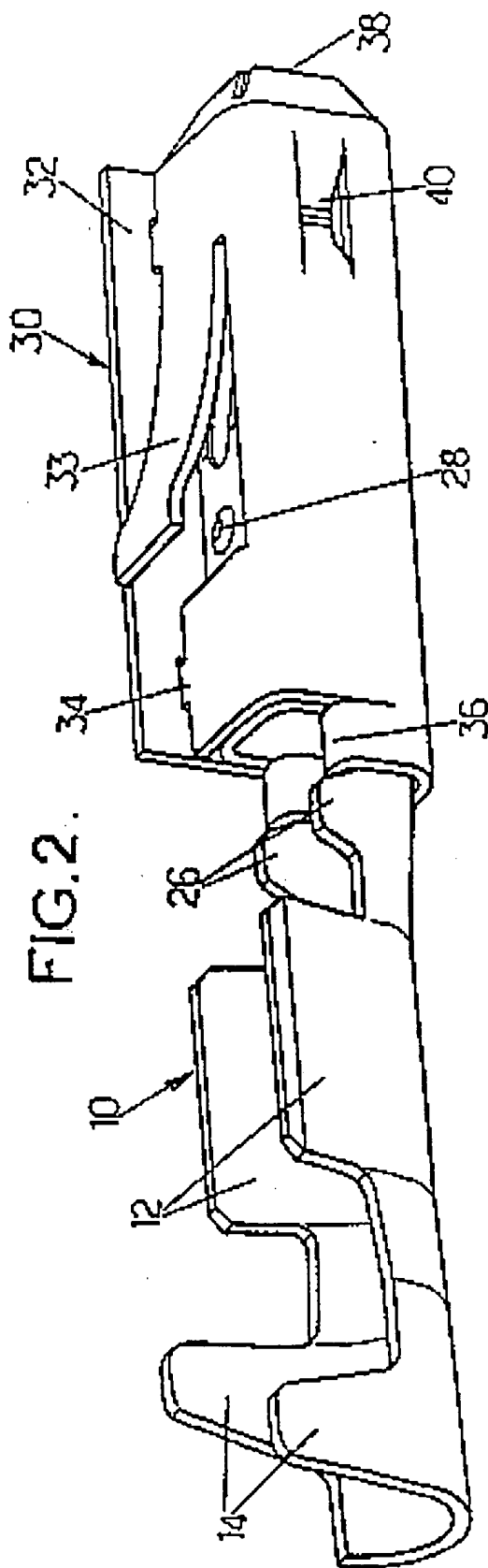


FIG.2.



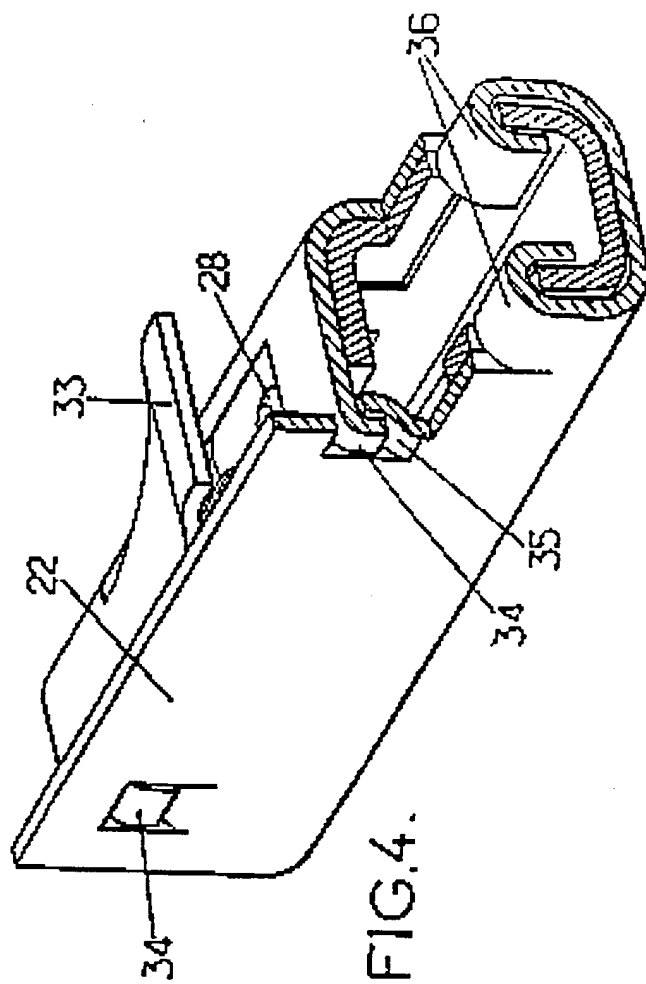
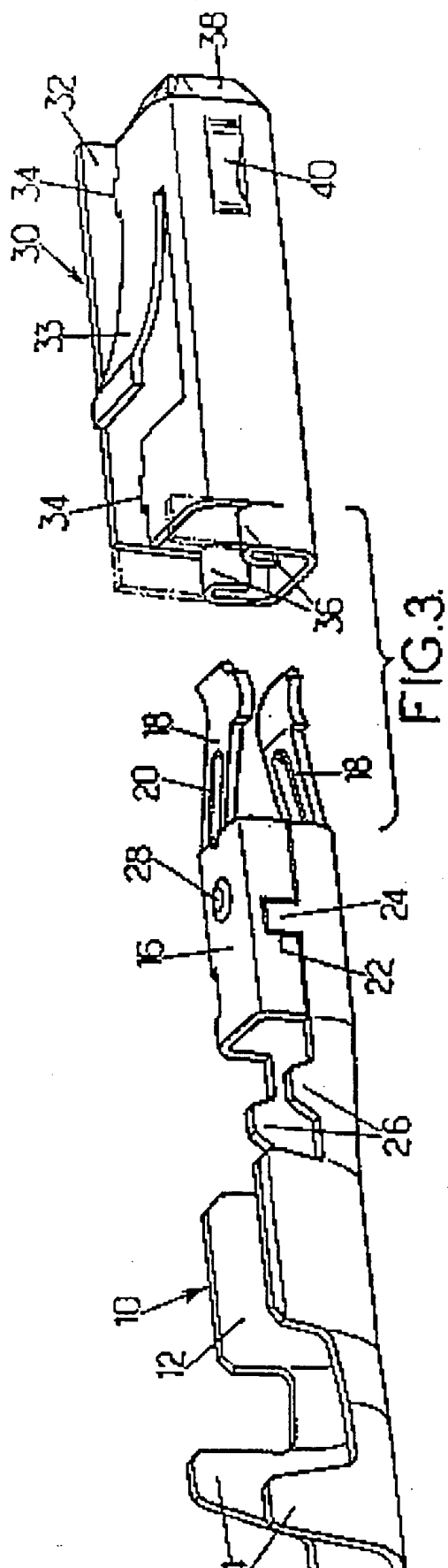


FIG. 5.

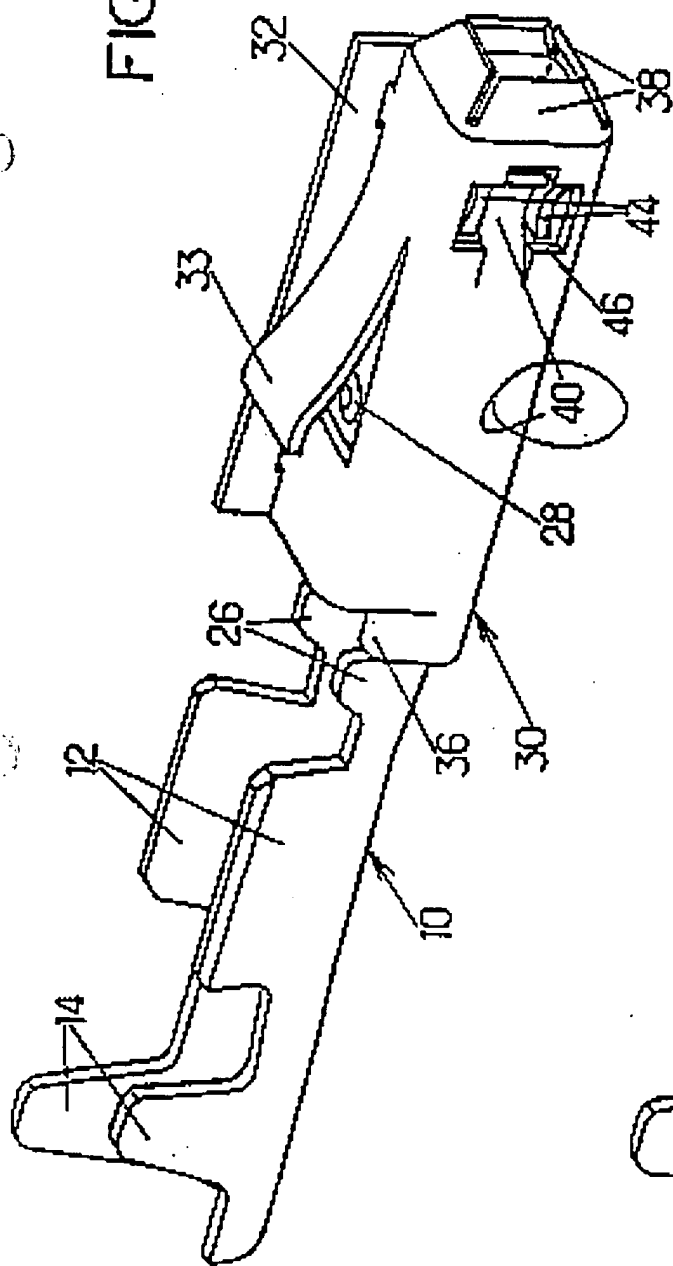


FIG. 6.

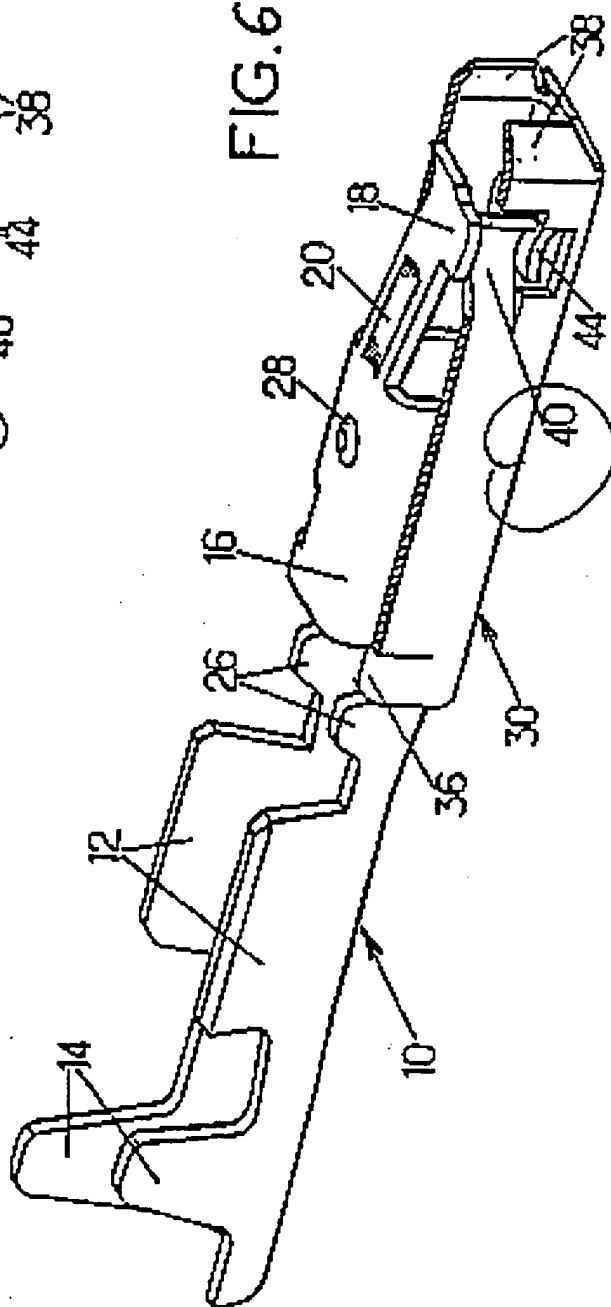


FIG. 7.

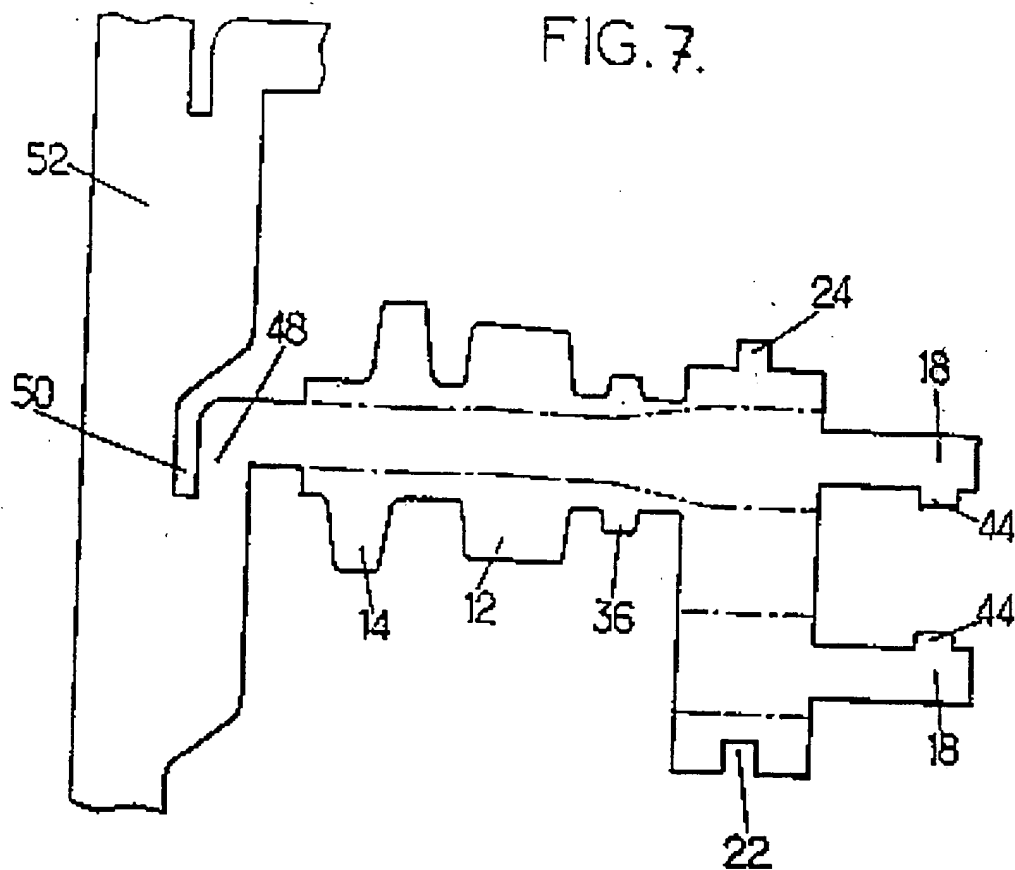
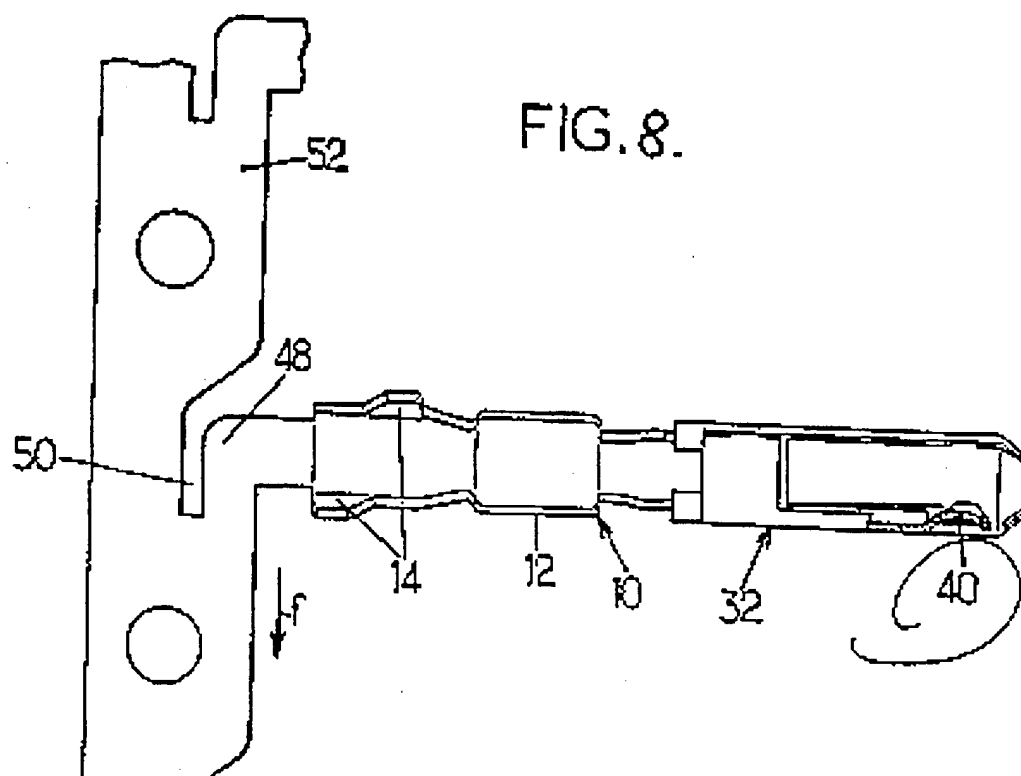


FIG. 8.



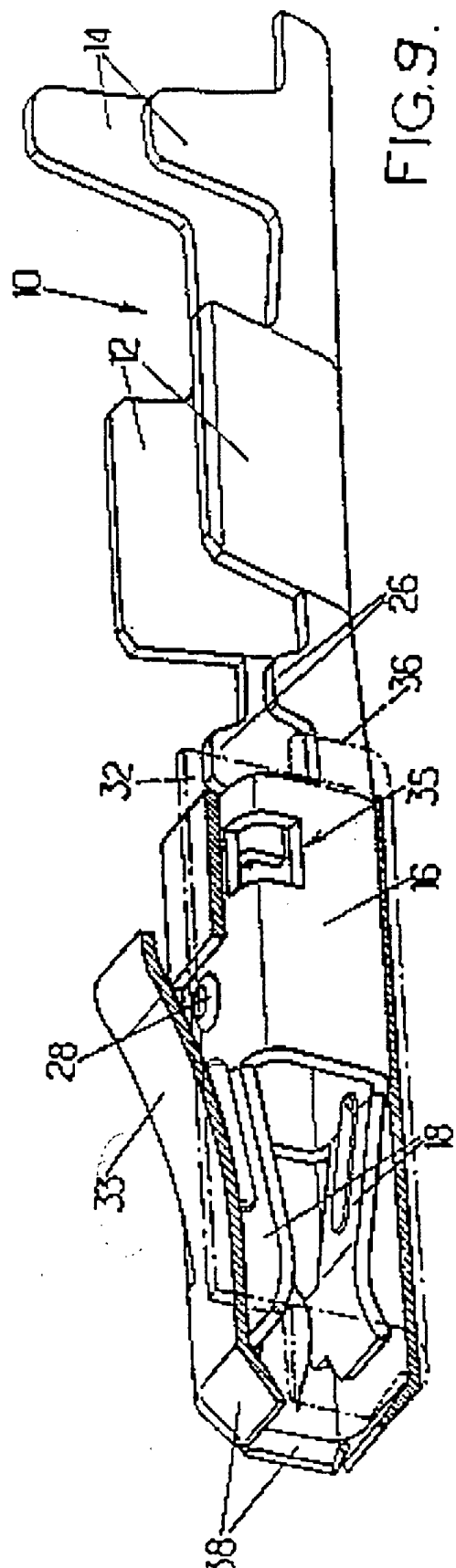


FIG. 10

